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Military Operations Research Society (MORS) Oral History Interview

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Danny Litwhiler Interview (MORS)

Litwhiler, Danny

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INTRODUCTION

Oral Histories represent the recollections and opinions of the person interviewed, and not the official position of MORs. Omissions and errors in fact are corrected when possible, but every effort is made to present the interviewee's own words.

Brigadier General (retired) Danny Litwhiler was Permanent Professor and Head of the Department of Mathematical Sciences at the U.S. Air Force Academy (USAFA) from 1986-2006, Chair of the Basic Sciences Division from 1994-2006 and Vice Dean from 1991-1994. Danny Litwhiler is the father of the interdisciplinary Operations Research (OR) major at USAFA and nurtured it for 30 years to ensure its continued relevance.

This interview was conducted by Dr. Bob Sheldon, FS, and Dr. Mike Lyons in Colorado Springs, Colorado, on 11 June 2006.

MORS ORAL HISTORY

Bob Sheldon: Let me first ask you to give us your parents' names and where you were born and raised.

Danny Litwhiler: My father's name is Daniel Webster Litwhiler, and my mother's name is Dorothy Lynch Litwhiler. I was born in Ringtown, Pennsylvania. It is a very small town with no stop light in it and the main street ends at the cemetery. They put a stop light in many years ago and then took it out a bit later because people were getting confused. That was my start. I grew up in Bloomsburg, Pennsylvania, and was raised there until the 7th grade. Then we went to Tallahassee, Florida, where I went to junior high, high school, and through my master's degree at Florida State University.

Bob Sheldon: Tell us a little about your dad.

Danny Litwhiler: My dad is the son of a farmer, who later became a hotel owner. My grandfather went blind at the age of 50. My dad's the seventh son of a seventh son; that's supposed to be lucky, according to the Bible. I think he is a fortunate and blessed man, because he had seven brothers and a sister and all but one went to college and became teachers. That was their future. My dad was a teacher, but also a pretty good baseball player. He played twelve years in the major leagues. He was in an

All-Star game and two World Series. He also had a wonderful career teaching as a coach. When he finished major league baseball, he ended up college coaching at Florida State and Michigan State, followed by a stint as hitting instructor for the Cincinnati Reds.

Bob Sheldon: I noticed on a web search, he also wrote a book.

Danny Litwhiler: Yes, he wrote a number of them on how to coach. He wrote three books and traveled internationally with the Olympic baseball program and also through the military giving clinics around the world. He wrote a small book on translating baseball into various languages, all the baseball terms. Amazingly, his autobiography was just released shortly after his 90th birthday. He has spent the past four years documenting his life story in *Danny Litwhiler...Living the Baseball Dream*. It's a fascinating book, whether you're a baseball fan or not.

Bob Sheldon: Did you have personal encounters with some of the other professional baseball players while you were growing up?

Danny Litwhiler: I was in grade school when he left the major leagues in 1950; I was about eight years old. My memory is pretty much of my playmates. For example, Dickie Musial, son of Stan Musial, was one of my playmates, and everybody's daddy was a baseball player. So we all still wanted to be firemen and things like that because everybody's daddy played baseball. That wasn't special. About the time I was 10 years old, and he was out of the major leagues, I realized, gosh, that was a great time. We'd have these bubblegum cards, and he would bring home a box of them, and my brother and I would eat all the bubblegum and throw the cards away. We helped the market, actually, because those cards from those years are more valuable now due to our actions. I saw a different side of many famous ballplayers as wonderful fathers and family men.

Bob Sheldon: What were your favorite subjects in junior high and high school?

Danny Litwhiler: Math. I went to a demonstration school at Florida State University. Our teachers were brought in, especially the math teachers, from the math education faculty at Florida State. They were outstanding math teachers; they created a love of mathematics.

Military Operations Research Society (MORS) Oral History Project Interview of Brigadier General Danny Litwhiler, U.S. Air Force

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Bob Sheldon: Geometry, algebra?

Danny Litwhiler: They didn't have calculus back then in high school. I didn't start calculus until I went to college. I took college algebra and calculus in the summer after high school, loved it, and did well in those courses. I ended up having math as a major because I did well in all the math courses. Being a math major at Florida State was an interesting challenge, because it's a very pure mathematics curriculum there. I didn't know about applied math. I went on for my master's degree there and was further introduced to pure mathematics.

Bob Sheldon: For your bachelor's degree, your major was mathematics?

Danny Litwhiler: Yes, in mathematics and math education; I had a double major and graduated with honors in math education. I was in Reserve Officer Training Corps (ROTC) and went year round on a trimester system, so I graduated in three years. However, I had another year of ROTC to complete so I started a graduate teaching assistantship in math. The Air Force was generous enough to let me continue with my master's degree after I got my commission, so I did that.

Bob Sheldon: Were you on an ROTC scholarship?

Danny Litwhiler: I was finishing my ROTC scholarship and they gave me an educational delay, because they really didn't need me on active duty right away. I had two years to get my master's in math at Florida State, which I needed, because it was a pure mathematics program. In one semester I took what they call an Applied Mathematics course. Everyone was all excited because they were offering an Applied Mathematics course titled Linear Operators on a Hilbert Space. However, the only numbers I remember seeing in that course were the page numbers in the textbook. If I had known about Operations Research (OR), I would have majored in that, but Florida State didn't have anything like that at the time.

Bob Sheldon: Did you do a thesis for your master's?

Danny Litwhiler: No master's thesis; lots of courses.

Bob Sheldon: Were you commissioned before you went to grad school?

Danny Litwhiler: I was commissioned midway through. I had my four years, got my commission, and had another year of grad school left. So for my last year in ROTC, I was a grad student. They didn't know what to do with me; what do you do with a grad student in ROTC? They made me Chief of Staff of the Army and the Air Force ROTC programs. That was great because I didn't have to march. The Chief of Staff has to have lots of meetings with his staff. That's my story and I'm sticking to it.

Bob Sheldon: Tell us about your own experience with baseball in college.

Danny Litwhiler: I hoped to be a college baseball player, since my whole goal in life was to teach mathematics in high school and coach baseball. That's what I was going to do. I knew that ROTC would divert me from that for a little while, but my father diverted me from that career path much sooner. I only played for him at Florida State for about a year and a half. I was a pitcher—a good batting practice pitcher. The team that he had went to the College World Series every year I was there, so I can credit myself for giving them tremendous confidence during practice. I was lucky I didn't get killed on the pitcher's mound. My father, after a year and a half, said, "Danny, I think maybe mathematics is your forte, not baseball." And I knew that myself. My own father cut me from the squad, cut me from the team. We still get along and love each other. As a result of my pursuing mathematics rather than baseball I ended up teaching math and coaching baseball at the college level. Not a bad tradeoff.

Bob Sheldon: Finishing up your master's degree, what kind of assignment did the Air Force have for you?

Danny Litwhiler: All the way through ROTC, I knew what my initial orders were going to be: Mathematician, Air Force Specialty Code (AFSC) 2625. That's what the draft orders said. Wow, I'm going to be a mathematician—couldn't wait. I had a master's in math, absolutely locked on that I was going to be a mathematician. Then I got my official orders; I was going to the ground electronics school at Keesler Air Force Base (AFB), Mississippi, for a year of schooling. They would have given me more time to get my doctorate, however there was no way I could have done it. I was so sick of

school at that time; I just couldn't wait to go do something productive. I did a year at Keesler ground electronics school and radar school productively tracing electrons around radio and radar equipment schematics; did both of them. On a long weekend between school sessions, I married Peggy Pendergast in Jacksonville. They told me I was going to be in the radar career field and go to the DEW (Distant Early Warning) Line. They said I'd be on a remote assignment within a year. However, after graduation they sent me to another school at Lowry AFB in Denver. It was an advanced radar school, leading to an atomic energy detection site assignment for the Air Force Technical Application Center (AFTAC). My first real operational assignment was going to be remote to Pago Pago, American Samoa, but my wife, Peggy, was pregnant, so I begged them to let me go earlier or go late so I could be home for the birth of our child. The AFTAC Personnel folks asked me, "How about going somewhere else where your wife could go with you," so, I said, "OK." That's a good personnel system. So we went to Chiang Mai, Thailand, 1967-1969. It was during the early Vietnam War years, just a couple hundred miles west. We had our car, all our household goods, and lived among the gentlest, kindest, most beautiful people in the world. Our first son, Danny III, was born over there. Our site was responsible for detecting atomic bursts, either air or ground; we had two systems. At the time it was a highly classified mission, and the cover story was that we were a weather station. Now it's unclassified.

Bob Sheldon: So, you took all that time in Air Force schools to learn all the technology things you had not learned in mathematics?

Danny Litwhiler: I was tracing electrons through wiring diagrams for a year. I could see the insides of height finders and search radars in my sleep.

Bob Sheldon: With the war going on in Vietnam, were you ever under any tense situations?

Danny Litwhiler: Not really in Chiang Mai. The Thais were very peaceful people. Foreigners there were mainly U.S. military folks who were on Rest and Recuperation (R&R) from Vietnam. They would come there, see us there, and were very jealous, of course. People for Air America were stationed there, and they would go out and come back on classified mis-

sions and sometimes they did not come back. It was geographically very close to the war, but we did not have any problems. Concern about possible problems with hill tribes led to our detachment becoming a remote tour in 1970. Later, the Thai government took over operation of the site.

Bob Sheldon: Rotating back from there where did you go to?

Danny Litwhiler: I would have liked to have stayed in that command. It had a fascinating mission with small sites all over the world. There were many opportunities to be a commander as a non-rated junior officer leading many of the brightest, most talented airmen in the Air Force. But they said that because of my master's degree I would not be able to do that. They thought I'd be going somewhere else with my advanced degree so I said, "Radar, I don't want to do that anymore." I knew about the DEW Line from my year of schooling at Keesler. So I applied for something called Management Analysis School. I had heard about OR and somebody told me that Management Analysis School might be a way to get into that field. That school was at Sheppard AFB, Texas. So I went to school again, for a short time, and became a Management Analyst. Management Analysts were usually assigned to numbered air force and higher headquarters Comptroller offices.

Bob Sheldon: Was that part of the Manpower field?

Danny Litwhiler: No, it was AFSC 6921 and was embedded in the Comptroller career field. The Comptroller in most commands is usually the more junior guy. Hence, the position and his folks are very responsive to commanders, but not wanting to make waves. I didn't think it was a real good place for a young analyst to be, because you couldn't make waves. But that's where the analysts were at that time. I believe breaking the analysts away from the Comptroller field was a very good move. My first assignment was to Headquarters, Southern Communications Area at Tinker AFB, Oklahoma.

Bob Sheldon: What kinds of things did you analyze?

Danny Litwhiler: We had the graphics and reports control shop under us and we did analysis at the beck and call of the commander. However, many commanders didn't know how

to use that group of people, nor did the comptrollers. You stayed quiet, you would track data, you would track communication system failure rates and efficiencies, build and maintain status charts and work on things like that. I did that for about five months and then I became the Comptroller. The Comptroller I worked for got fired so I did both jobs for a while, until a replacement could be assigned. I decided this is not what I wanted to do either, so I put in a volunteer statement to go overseas. I figured that would shorten my tour at Southern Communications Area. Our twin boys, Chris and Kevin, were born while we were at Sheppard AFB, and we thought going overseas while our children were young would be easier on the family. I got picked up within months of putting in that dream sheet to go to Japan as an AFSC 0076 Programs Officer, which was unusual because I was a junior captain. Usually, in that field, you are a major or above. The Fifth Air Force headquarters in Japan is where I went. The head planner at Fuchu Air Base, Colonel Harry Lauterbach, was a really brilliant man with only a high school education, and one of the best writers I've ever known. He believed that with what they wanted to do over there, phase down all of the U.S. forces in Okinawa and the Kanto Plain area in mainland Japan, they needed an analyst of some kind. So he created a position for a scientific analyst or a management analyst and I was the person picked to do that. I went over there to do program officer work for about a year and a half.

Bob Sheldon: Were there any specific decisions you impacted?

Danny Litwhiler: The young captain that I was, I was responsible for the closure of nearly all the Air Force facilities on Okinawa, including Naha Air Base. Naha Air Base became an international airport. Kadena Air Base was the only major Air Force installation left and all other small sites were consolidated to Kadena. The closure actions were a joint operation because we were working with U.S. Forces Japan, and the other services were also involved. When I was finished with that I helped with the Kanto Plain (greater Tokyo) consolidation work. All the small bases in Tokyo were consolidated to Yokota Air Base. Tachikawa Air Base, Fuchu Air Base, Kanto Mura, and Grant Heights were

all returned to the Government of Japan. It was a 24/7 style operation, especially meeting the demands of Okinawa Reversion. However, we found time to add our daughter Heather to the family, born at Tachikawa Air Base before it closed.

Bob Sheldon: Did you do any quantitative analysis to support those decisions?

Danny Litwhiler: My job was mainly getting all the Fifth Air Force disciplines of civil engineering, budget, manpower, and others working together as a team. It also included coordinating with U.S. Forces Japan. I was team leader, that's what I was. There really wasn't much analysis to be done, but it was working with teams. The last thing I did there, with the Kanto Plain consolidation, was the manpower aspect—eliminating slots—and I eliminated my own slot, picking the month and year. Now I had a perfect opportunity to plot my future. Only my boss and I knew of my upcoming curtailment, so I contacted the USAFA math department. I had already been turned down by the USAFA math faculty three times in my brief seven years in the Air Force. I applied for an Academy assignment as a lieutenant and they kept saying, "Have a nice assignment, call back in a couple years," which I did, every time. I turned down an opportunity to go to Pacific Air Forces (PACAF) Headquarters, because I was a PACAF resource. They thought I was nuts but said I could go to the Air Force Academy, so I first got to the math department in October 1972.

Bob Sheldon: Who was the head of the math department?

Danny Litwhiler: Bob Lochry had just arrived as the first Permanent Professor of Math Sciences the previous summer. Prior to that, Permanent Professors from other disciplines and few other officers had been the department head on an interim basis.

Bob Sheldon: What did you teach?

Danny Litwhiler: He brought me to USAFA in the middle of the academic year, without an interview, probably as a "desperation" hire—remember they had turned me down three times. I came in to take over the course load of one of the officers who had not finished his doctorate and was running up against some deadlines. I didn't have many additional duties since the academic

year was well underway, so I went down to the athletic department and asked if they needed help with the baseball program. They did.

Bob Sheldon: Were you the head coach or the assistant coach?

Danny Litwhiler: I initially was the assistant coach for the junior varsity. We played such teams as Canon City Prison; they were one of the few teams that beat us soundly. They had some good ball players in those prisons, we found out. When the pitcher and catcher are both there for Murder One, it's not wise to dig into the batter's box very deep. The umpires also knew their calls would be reviewed by their cellmates later that day. That's what I did. I coached baseball and enjoyed that immensely. Talk about a Walter Mitty life; getting to teach math at USAFA, not high school, and coach Division I baseball.

Bob Sheldon: Did you feel well prepared to teach calculus?

Danny Litwhiler: It came back. I had earned a teacher's certificate for high school and junior college at Florida State and had taught night classes as an adjunct for a couple of colleges. However, I think I was just like nearly every other new instructor in the math department at the Academy. You come in to the assignment very nervous. What am I going to do with these kids that come in and are so bright and what's it going to be like? They were very bright, but it was so exciting to teach them that you have all the energy in the world to prepare those lessons and do it right.

Bob Sheldon: What else did you teach after calculus?

Danny Litwhiler: In that first assignment that's what I taught, calculus, because I was only there a year and a half. They came down the hall one day saying, "Does anybody want to go and get a PhD?" And I said, "I do." So I went off to get a PhD.

Bob Sheldon: Were you sent to get a PhD in mathematics?

Danny Litwhiler: No, it was in Operations Research, actually Industrial Engineering, at the University of Oklahoma.

Bob Sheldon: Did you get to choose your major, or did they choose your major for you?

Danny Litwhiler: I got to choose it. I really wanted to do something more applied.

Bob Sheldon: How did you choose your school?

Danny Litwhiler: When I was assigned to Tinker AFB, I had taken some night classes at the University of Oklahoma and got to know the faculty. I took Introduction to OR and a statistics class. Knowing the faculty and who they were, I was very excited about having the opportunity to go back there, especially on Air Force and USAFA sponsorship, to get a doctorate in Industrial Engineering with emphasis in OR.

Bob Sheldon: Did they give you three years to finish?

Danny Litwhiler: The Air Force gave me three years but I told my major professor that I only had two and a half since the taxpayers were funding my education, and that actually worked. I was able to do it in two and a half years. I was there for about three months after defending my dissertation. In that time period my major professor and other committee members beat four publications out of me.

Bob Sheldon: You took an Industrial Engineering curriculum with mostly OR courses?

Danny Litwhiler: Mostly OR, but also a sprinkling of the entire Industrial Engineering curriculum, human factors, ergonomics, and organizational theory, all that.

Bob Sheldon: Any notable professors that you recall?

Danny Litwhiler: Bobbie Foote made a reputation working for the military services as a consultant in stochastic processes and OR. Most recently, he was at the Military Academy on their faculty in Systems Engineering. My major professor, Adel Aly, is widely published in various OR disciplines. He's currently at Kuwait University.

Bob Sheldon: What was your thesis topic?

Danny Litwhiler: Being an Air Force officer, my thesis was *Optimal Location on a Sphere*. Location theory was relatively new at the time, and I looked at everything they had, and said, "Gee, nobody is writing or talking about solving spherical location problems," so I did that. It ended up being a messy problem, because it's non-convex and not very easy to optimize.

Bob Sheldon: Nonlinear?

Danny Litwhiler: Nonlinear—it was a messy problem. I had to learn spherical

trigonometry, which helped somewhat, but optimizing most large region problems is a brutal battle.

Bob Sheldon: Did you have Air Force customers who were interested in your thesis?

Danny Litwhiler: No, not at the time, but it ended up that someone did use the work years later. I think it was Military Airlift Command (MAC), and some young man down at the University of Southern Colorado did a master's thesis on trying to extend my results. He was not able to extend them. He was, however, able to track down someone in the Air Force using my work. Of course, working on a sphere (earth), you have spherical geometry involved and optimal locations are affected. However, long distances have to be involved before there is any real effect. And then optimizing is more of a numerical search algorithm due to the nonlinearity. You look at it in three dimensions as opposed to trying to optimize to a closed form solution.

Bob Sheldon: Did Colonel Lochry have any specific job in mind for you when you returned to the Academy?

Danny Litwhiler: I was fortunate to get a below-the-zone (BTZ) promotion to major shortly after arriving at the University of Oklahoma. That created a problem for him, because now I was a potential staff member as opposed to just returning as a captain, which was his original plan. I don't think he really had any idea what I would be doing when I came back. I got to teach OR and statistics courses rather than Calculus I and II, which was good.

Bob Sheldon: To get a BTZ promotion for a guy in school was pretty tough.

Danny Litwhiler: It blew my mind, too. It was a big surprise. If you had seen my early OPRs (Officer Performance Reports), you might say, "This guy might not make Major." I attribute it to the work I did in Japan and Colonel Lochry taking very good care of me. When he sent me off to school, I had a superb "on top" OPR from him and it worked out.

Bob Sheldon: Coming back, he had to put you in a staff job as a major?

Danny Litwhiler: Not right away. I was a grunt instructor for awhile, and then he went on sabbatical and left two young colonels in charge: Tony Johnson and Paul Ruud. Tony Johnson was the department head and Paul

Ruud was his deputy. They ran the department as a team. My first opportunity as a math department staff member was when I worked for them. I was the executive officer for Tony and became the OR Division Chief. They came down the hall one time. I was looking for my next job, and I thought I'd be going to Studies and Analysis in the Pentagon or something like that. They asked me if I'd like to stay on as a tenured officer. I said, "Ok, I think I'd like to do that." I was coaching baseball again; I was with the varsity, and we were doing well and I was the OR Division Chief. I was truly in heaven on earth. Different levels of heaven—I was in the 7th heaven. It couldn't be better than that and then these two wonderful gentlemen asked me if I would like to stay and I did. Then Colonel Lochry came back from his sabbatical; I hoped he was happy that I was going to be around, and I was around for a little bit longer.

Bob Sheldon: Was the OR curriculum across the departments like it is now or just in the math department?

Danny Litwhiler: Let's talk about the OR curriculum a bit. It first got started in early 1971-1972 and that was when Colonel Lochry first came. Being a physicist, it's interesting that he thought there was a need to do that. There was an officer named Walt Brown, a mechanical engineering PhD, who was tasked with creating the OR major. He had never taken an OR course in his life. He started working on it with some other officers that were here at the time. Ben Tindall had come back from Georgia Tech—supposed to have his PhD in hand—but, he was still busy working on his dissertation. A year later Warren Langley came with his OR doctorate in hand and he started teaching the OR courses. Then they called in Lt Col Bill Hodson who came back for his third tour to get a handle on this new OR curriculum. Walt started it off by teaching an Introduction to OR course because he knew nothing about OR and so he figured, "OK, that's what I'll do" and got familiar with it by teaching it. The first "virtual" OR majors were in the 1976 time frame. Maybe a dozen were interested in it. They were not OR majors but were math majors in an OR track. John Andrew, the current Permanent Professor and department head, is one of the early OR track math majors. Our first

OR majors graduated in 1979. There were three of them. They were allowed to do that because they had coincidentally taken all the OR requirements by the time of their graduation in 1979, but the first majors graduated in 1980. The math department had the idea of having an OR major and wanted it to be a math department major. Of course, you know what that would have been; it would have been a lot of mathematics and stats. That raised the specter of turf battles with other departments wanting a piece of the action. Colonel Lochry lost the battle for a single department major, with his peers saying, "No, it's going to be interdisciplinary. You can do that with computer science people and the econ-management people." It started out as an interdisciplinary major with the econ, geography, management department, what they called DFEGM, and the math department DFMS. They were the two that had the major. They actually had two tracks because they really couldn't come to an agreement on who would do or teach what.

So, we had a management track and a math track. The first two classes to graduate, 1980-1981, were in that dual track. I had come back from my doctorate in 1977 so I saw this as it was developing and then I became the OR division chief. Bill Hodson was the creator of that first go at it and I taught courses in the math track. What I discovered really quickly was that the two track system was not going to work. It was created out of turf battles and those did not stop. We had the management track being advertised by them as the applied track. Whenever anybody went to see them, they would say, "You really don't want to do that other track, because it is all theory, that's all you are going to get, and we are management and we know how it's done." We could see what happened there; it was not healthy. Then Econ split off from Management. Now we had an Econ department, a Management department, a Computer Science department, and a Math Sciences department. When they split off I went down to the Management department and talked to a young man named Major Jim Downey. We decided to see if we could make a truly interdisciplinary major with one track. I drafted up the proposal and we got Computer Science and Econ to participate since they had been shut out and were

very anxious to come back into the fold. It was an opportune time to do that—for management and us—and we created about ten new courses, an applied linear algebra course, a good statistics sequence capped with experimental design, time series analysis was taught by Econ, of course, computer programming and queuing theory taught by Computer Science, and Management taught some regression and management techniques. Management and Math split a four sequence course in OR techniques. We took two in math and management took two. Everyone seemed happy.

Bob Sheldon: Did you have a capstone course back then?

Danny Litwhiler: No real capstone; you could say the fourth OR course was a capstone, but it really wasn't. And it worked out amazingly well. As far as we know, we were the first school in the nation to have an undergraduate OR program. Many people just did not believe it should be done. They thought undergraduates couldn't do it because OR majors are supposed to integrate knowledge and how are you going to integrate fundamental concepts if you don't have the tools to integrate? We took the philosophy that, "If we need a second lieutenant analyst, we have to do this. We can't wait until they have their master's degree." Along with the philosophy that just-in-time education might work, you teach them the tools they need as they need them and they will start learning to integrate as they develop through the program. I think it works very well. We have evidence of that; we have graduates from the last 20 years that are doing amazing work for the Air Force and in industry with a bachelor's degree in OR from USAFA.

Bob Sheldon: Gene Woolsey was one of those critics of undergraduate OR programs.

Danny Litwhiler: Yes, he was.

Bob Sheldon: Has he ever commented explicitly about USAFA's OR degree?

Danny Litwhiler: No, not that I recall. Gene doesn't really change his views. (*Laughter*) He's a believer in the applied concept and using the tools and that's what we do, although he's also a really good theoretical mathematician when he needs to be. We have had some excellent conversations over this concept, yet we need someone as a second lieutenant to be an analyst—we can't

wait. We don't want a pure mathematician, we don't want a computer scientist; we want an analyst. And that's what we create with our program.

Bob Sheldon: You had three students graduate initially. Did it pick up quickly?

Danny Litwhiler: I'd say steady state, there are about 40 graduates a year in OR, although most of them go off into pilot training. On average, we had 40. In the 1987 or 1988 time frame, we had 71 OR majors, that was an all time high and the next year we had 64 or 65. That's due to getting out and selling people on it; because so few cadets know what OR is when they come here. A majority of cadets that come here want to be astro or aero majors, and then they find out about OR, so there is a lot of salesmanship involved. Our low was nine and we are going to have nine for next year, which is going to be our low, which is sad. How did we fall so low? Just nine in 2007, if they all graduate, and some of them will be pilots. What happened is that there is an external influence. The Air Force Personnel Center (AFPC) decided a couple of years ago that they needed every analyst that we graduate to go into the scientific analyst career field if they were not pilot qualified. That was almost a death knell for the major, because these OR majors are very bright, they often rank in the top of their class, and they would like to have some options. What happened was that the Class of 2006 was told that they cannot pick their career field. Even though you could be an Intel Officer or an Acquisitions Officer, or you name the field, you could not pick it; if you were an OR major you were going to be an analyst whether you wanted to be or not. It did not take long for the Cadet Wing to figure out, well, do I really want to do this? I could become a math major or an engineer or a management major and get to pick my field. I could even be an analyst but only if I wanted to. As a result, that's the impact; it went from 71 to 9 OR majors graduating. I'm hoping our appeals to AFPC will be accepted and the bad idea is repealed.

Bob Sheldon: Let's go back to the 1970s when the department brought the OR curriculum in. How long did you stay at the Academy your second tour?

Danny Litwhiler: In 1977 I came back from my doctorate and in 1982 I went off for an oper-

ational tour—in the academic world they call it a sabbatical. I was a young lieutenant colonel and I'd been here a long time—1977 to 1982—and I decided it was time to do something else. I had the opportunity to be the first person from the Academy to go on sabbatical to the Secretary of the Air Force Staff Group, directly working for Honorable Verne Orr, Secretary of the Air Force, as a speech writer and policy analyst, for one calendar year. I did that and lived in DC. My family stayed here because I had four children in school and it spanned two school years. I wrote speeches, but not many policy speeches. They wouldn't let me do that as a PhD in Industrial Engineering. They couldn't figure out what to make me do, so I wrote what I called "supermarket opening" speeches for Secretary Orr, when he had to go out and "glad hand" and be Secretary Verne Orr at various official functions. I was the speech writer for many of those events. The one policy speech I wrote for him was to an engineering society that he talked to and he was very glad to have me on the staff for that particular one. I got to write some articles, by-line articles on space, for him with a lot of help from other people. Overall, it was a wonderful year working for the Secretary of the Air Force.

Bob Sheldon: Writing speeches for Secretary Orr, how did you construct the verbiage to match up with the verbiage he wanted?

Danny Litwhiler: The magic is in an interactive process where you write a speech, he takes it, he gives it, you tape it, and all of a sudden you realize what he really likes. In the next speech you are working from the way he likes to talk, and the feedback you get from him. After that next speech you write, it's, "that's amazing, it's like you are inside my head, Danny."

Bob Sheldon: By the time you had been there a year; you were pretty good at it?

Danny Litwhiler: He was such a naturally good speaker. He was so good at expressing himself, making contact with the people he was talking to, he made us speechwriters look wonderful.

Bob Sheldon: Were there any major Air Force policy decisions you had to work on that year in those speeches you wrote?

Danny Litwhiler: Not in the speeches, but I saw 10 billion dollars get cut from the Air Force

budget over a weekend by the financial management people that worked for the Secretary while I was on loan to them. It just happened they needed everybody in there, but it was a weekend. Unfortunately the timing was so crucial that it ended up the staff work was done by a major and a lieutenant colonel in the middle of the night and ended up being accepted with few changes by all the 4-stars. It was fascinating to be a participant in that event.

Bob Sheldon: This was a cutback during the Reagan administration?

Danny Litwhiler: Yes, when the Air Force Secretary was Verne Orr. It was a huge budget crunch. The program budget was not going to work—cut 10 billion. Oh, my goodness, this weekend? And it was done—it was painful. Another thing that came through that I recall was a trimester plan for USAFA. Trimester; go from semester to trimester.

Bob Sheldon: Like the quarter system?

Danny Litwhiler: Yes, it was like the quarter system but three full semesters are crammed into a year. The summer trimester also had two half trimester sessions, whatever that is; but it did not fly.

Bob Sheldon: Who was trying to sell that?

Danny Litwhiler: The Academy—they wanted it bad.

Bob Sheldon: What was the rationale against it?

Danny Litwhiler: When I was on an airplane flying with the Secretary to a function, the Public Affairs Officer for the Air Force and the Secretary, the two of them, together, sitting behind me, killed it.

Bob Sheldon: For political reasons?

Danny Litwhiler: As I recall, Secretary Orr said, "I don't think I like this at all; I've heard about these trimester programs."

Bob Sheldon: Usually, it's the one extra administration/registration process.

Danny Litwhiler: No, that had nothing to do with it. I think what happened there, the Academy staff work, sadly, did not follow the package and they lost their opportunity. There was another officer on the Secretary's Staff Group with Academy ties at the time. I think we could have helped sell the package, but we didn't know it was there for Secretary of the Air Force approval until it was too late.

Bob Sheldon: After that year's experience, you returned to the Academy?

Danny Litwhiler: Yes, I came back to the Academy and got promoted to colonel. Working for the Secretary of the Air Force did not hurt. 1984 was when I got promoted. Then I had to leave again because of some obscure Air Force regulation that says if you never attended a service school in residence and you are promoted to colonel, you will go. So, I went. They found a school for me to go to—Industrial College of the Armed Forces (ICAF)—a wonderful place to go.

Bob Sheldon: Did you play golf?

Danny Litwhiler: No, but I trained to run a marathon—my one and only marathon in my whole life. After which I never ran another race—not ever. My last racing tee shirt came from the Marine Corps Marathon in 1985. I did not want to go to ICAF. I went to the Dean and said I did not want to do this. I'd rather stay at the Academy. General Rokke was the Dean at that time. He said, "Danny, if you ever want to come back to this place, you have to leave and leave now. You can't come back if you don't leave, and if you don't leave, you won't be able to stay here." I knew General Lochry was going to retire in a couple of years, at age 64, mandatory retirement for Permanent Professors. I knew I had an outside chance at being his successor, though not real good. General Rokke said to have the best chance, you have to leave. So I did, and it turns out while I was at ICAF, General Lochry decided to retire about a year or so early. I was looking for jobs; everyone else at ICAF was getting their jobs and they are not giving me one because I applied for the position of Department Head and Permanent Professor of Mathematics. They kept saying, "You just have to wait." One of the hardest positions for some reason to fill is the Permanent Professor positions. They say the Catholic Church can pick a Pope faster than the Air Force can pick a Permanent Professor, and it's usually very true. I was offered a number of jobs in the ICAF assignment process, but as you can imagine, I didn't want them. I was offered a job held by one of my competitors for the position, because AFPC was absolutely certain he was going to be selected. I waited and waited and waited, and I finally found out. I found out I was selected.

Bob Sheldon: Do you know how many competitors you had?

Danny Litwhiler: I had about ten outstanding competitors for the job. General Lochry had an amazing ability for getting people promoted to colonel, so, a lot of people were applying for that job, a lot of very highly qualified people; somehow they picked me.

Bob Sheldon: What year did you become Department Head?

Danny Litwhiler: It was 1986, that summer after graduating from ICAF. Here we are about twenty years later. I was a colonel for over twenty years. No fogley pay raises since 1990. *(Laughter)*

Bob Sheldon: 1986 was when I came to the math department.

Danny Litwhiler: 1985, in August, I was promoted to colonel.

Bob Sheldon: Did you know what kinds of things you wanted to change in the department when you took over?

Danny Litwhiler: I really wanted to see applications come into the classroom, I wanted to see research get started, not so much research to publish, but, research via consulting, getting out and about, and to get the young officers doing consulting work. I viewed the Academy as graduating two groups of people; one is the cadets and one is the young faculty, like you were. And then go out and have an impact on this Air Force of ours like you did—that was the goal.

Bob Sheldon: How did you make that happen?

Danny Litwhiler: For the interview of a permanent professor candidate, one question was, "What is your view of a permanent professor?" I said, "A shepherd. You hire the best people you can get—and not call them sheep, whatever you do—and stay out of their way, encourage them and let them do their thing."

They are very talented and productive people if you pick the right ones, and that has worked amazingly well. I've often told our troops as they come through that we could, as a group, pull ourselves out of USAFA and form a company and just tear this earth apart with the things that we can do. It's amazing the talent that comes through here.

Bob Sheldon: Did you use a lot of your personal contacts around the Air Force?

Danny Litwhiler: The contacts came with the people that came in—the young officers. They kept links with the leadership in the commands they came from. Due to my eclectic background, I did not have that many contacts in the analysis world. But, the faculty that I hired knew so many different people and made those links work. Once you get started, once this ball gets rolling, it's amazing how people come running to you for help, and the impact you can have. We're just sitting out here teaching calculus and statistics and the phone starts ringing. In a few years, we went from seven researchers up to 35-40 researchers, almost three-fourths of the department doing research. It was applied research pretty much, consulting with different DoD agencies—about 20-30 agencies a year getting help from the math department. This meant getting cadets involved, also.

Bob Sheldon: Do you feel like you invoked some philosophical changes in the curriculum with the math majors and OR majors?

Danny Litwhiler: I think the biggest impact, something I started with Col Lochry's encouragement and support before I became the head, was the OR major becoming interdisciplinary. I have been so pleased with the way that has worked out; to get four departments to work together so closely, for the same mission, to create these superb young analysts. The model was used, more recently, to create a new interdisciplinary major, a systems engineering major and systems engineering management. This new major was a goal of the Air Force Secretary and the Chief Scientist. They wanted to see that happen, and we thought about it a little bit, and thought, "Do we want to let them push us into this?" But this was such a good idea, we jumped on it. The engineering departments took our OR major model and created this other interdisciplinary major. It's also very popular right now.

Bob Sheldon: Is that similar to West Point's systems engineering major?

Danny Litwhiler: I'd say it's very similar. We studied theirs, and put ours together. We had very few systems engineering graduates on our faculty. One officer in the math department had a PhD in systems engineering, so it does have an OR flavor to it. Some say it's competition for the OR major and affecting the number of potential analysts we can create, but they

are learning things that the OR majors don't get exposed to.

Bob Sheldon: Systems engineering is interdisciplinary between which departments?

Danny Litwhiler: All the engineering departments, the management department, and the behavioral sciences department, which has a human factors track. There are maybe five or six different systems engineering tracks.

Bob Sheldon: I know you went to Stuttgart, Germany. When does that come into the picture?

Danny Litwhiler: That was another sabbatical. From 1986 to 1992, I was the department head, and in late 1991 General Randy Cubero, the Dean, asked me to become his Vice Dean, so I went down the hall to do that. Then I came back to the department in 1994. After another six years it was time to do something else. I decided I would try to get overseas again. I had an opportunity to go to Stuttgart and work at Headquarters (HQ) United States European Command (EUCOM), in their Plans shop, J5. I told them all I needed was a desk and a phone, and I would do whatever they needed done. I got there and within a couple of months, Secretary Rumsfeld decided that he needed to have a worldwide theater basing study, to determine how many bases and how much real estate we need in the European theater. It was to be a huge joint effort and they looked around and said, "Who can we find to do this?" "Well, Litwhiler is sitting down there with a phone on his desk; he can do this." So I headed the HQ EUCOM team to determine future basing needs in Europe.

Bob Sheldon: Was that part of Base Realignment and Closure (BRAC)?

Danny Litwhiler: It was done before BRAC because Secretary Rumsfeld decided he could not pull off a BRAC in the U.S. unless he did this first. He believed he needed to look at all the basing all over the world, and Europe had most of it, to determine what is really needed, and then he could do BRAC. That was our job. Trying to get the Army to give up all their excess land over there—that's not easy. The Navy didn't have much, the Marines didn't have much, but they were part of the team and certainly had bases over there in various ports. The Army had unbelievable pages and pages and pages of acreage. They had won this acreage during WW II and they were not about to

give it up easily. We helped them figure out what they needed to give up.

Bob Sheldon: How did you convince them to participate?

Danny Litwhiler: I didn't finish it. We wrote the original plan and then I got to leave. (*Laughs*) I came back to the Academy. A Navy officer took over polishing the draft plan into final form.

Bob Sheldon: What kinds of thought processes went into closing, for instance, Bitburg instead of Spangdahlem?

Danny Litwhiler: It wasn't so much Bitburg versus Spangdahlem. It was changing the whole concept from heavy armor to Interim Brigade Combat Teams—very light and very fast units from very heavy and very slow tanks. Tanks in Europe, we saw what happened, Fulda Gap, and all that. They had to change their mindset and they were in the middle of doing that. That had a tremendous impact on what they were going to give up and what they had to keep.

Bob Sheldon: Did you have to travel around to most of those bases in Europe?

Danny Litwhiler: No, we didn't. We let the components do that and they would come in to Stuttgart with status reports. What we did create for the civil engineers, was the first document that actually listed all of the holdings of all the services – it was huge.

Bob Sheldon: All the Services real property in Europe?

Danny Litwhiler: All the real property in Europe; it was unbelievable, all the little hidey-holes they had out there. Some of them were very nice and some of them were also very valuable to the host countries. Others were dilapidated and crumbling abandoned acreage. It was similar to the Okinawa and Kanto Plain consolidation in Japan, which I had done decades earlier. Trying to figure out what to give back to the Japanese and doing quid pro quo things. We'll give you this golf course if you give us five huge apartment buildings on Yokota Air Base. And they would say, "Awesome," knowing all they can do with golf course acreage in their land locked situation. That situation was now happening in Europe. Some of the Germans were very anxious to get the land back, but the local Burgermeisters and area merchants were very unsettled about the fact that we would close Bitburg. It's a huge economic impact. They

didn't want our tanks, but they certainly wanted our people and our money. That was all ongoing.

Bob Sheldon: What kind of people did you work with at Stuttgart?

Danny Litwhiler: With the Service components; the Navy from their headquarters in London, the Air Force at Ramstein, the Army would send their Heidelberg guys down, and the Marines were right there at Stuttgart.

Bob Sheldon: What kind of guys did they send?

Danny Litwhiler: They were planners and programmers from their plans shops. Most of them were civilians, but not the Marines. Marines are Marines. The Navy sent a senior civilian, the Air Force sent some officers, and the Army sent a couple of senior civilians from their plans shop at Heidelberg. They had been there a long time, so it was a very interesting challenge to get them to come on board and trust us, trust EUCOM Headquarters, trust the joint people. They were not used to doing that. They became wonderful team members, though. I was honored to be able to work with them on this important project.

Bob Sheldon: Did you have to study operational impacts of those changes?

Danny Litwhiler: That was being done by the components. The Army was the one with the biggest headache and task because of the new concept of Brigade Combat Teams. They didn't expect they would have to do this basing study prior to the new concept coming into play.

Bob Sheldon: Did the senior civilians in particular have any real negative reactions to working with you on the basing study?

Danny Litwhiler: The Army, due to the Army leadership not buying into the task right away, initially held back. The Navy was extremely helpful. They had a man, John Hibbard, who was extremely helpful; he's now working with the Air Force in Omaha. When things around the table started getting heated up, he was often my mediator to help get these Army guys to be more forthcoming in the early stages. He had been working with them for years on other issues, hence had their confidence.

Bob Sheldon: After a couple of years there and returning to USAFA, were there any real changes here?

Danny Litwhiler: Since I came back, the last few years have been brutal. If you have been reading the papers, there have been a lot of very unfair, unwarranted attacks on the Academy and the cadets. It's been hard, but we are coming out of it.

Bob Sheldon: You had a couple of years as the Vice Dean; did that give you a different perspective on the Academy?

Danny Litwhiler: I was able to see the entire Academy mission and how it works. It was a fascinating time. General Hosmer, Class of 1959, was the Superintendent, and Paul Stein followed shortly thereafter as Superintendent. So I saw two different Superintendents in operation; it was a good time. It was kind of the golden years for the Academy. I really enjoyed working for General Cubero, our Dean; what a boss he was. That was good. Now, General Hosmer had a situation where he had to address sexual harassment issues. He had the entire base population, everybody working on the base, assembled in the basketball arena to talk about it. But, it didn't get the overreacting media and external attention that we have gotten over the last few years.

We are so far west that they usually don't pay much attention to us at USAFA. But all of a sudden, it became a huge publicity thing. Many of us at USAFA believed that we were not being protected at all by people who could have done that—we had no top cover. We lost a wonderful Superintendent, General Dallager; he caught the spear for all of us. And, it did not get any easier. General Weida also had some troubles over religious freedom issues. It's just amazing to see relatively little things get blown up so big.

Bob Sheldon: Let me backtrack to your first experience with MORS, attending a symposium; when did you first go?

Danny Litwhiler: I was out at Monterey and I went to one at West Point, but I can't recall the years, now. What a fun gathering that event is.

Bob Sheldon: Did you present a paper?

Danny Litwhiler: No, I did not present a paper. I hire people to present papers. I hire smart people and in 20 plus years they continually made me look smart.

Bob Sheldon: What was your impression of the symposia?

Danny Litwhiler: Outstanding—analysts sitting on top of analysts. Analysts sharing their miseries and sharing their trials and tribulations. You can't get a better gathering of good people.

Bob Sheldon: You sent a lot of your folks over the years?

Danny Litwhiler: Absolutely. We try and send the young officers to get an idea of what it is like. I hope we continue, like the one that is ongoing right now at USAFA. I hope some of the cadets get to go. Unfortunately, it's the start of the summer and they are scattered all over the world. It's great to get some of the cadets to go and know what the analysts are currently doing. The young analysts get so much out of that—and come back to the classrooms all pumped up.

Bob Sheldon: Let's talk about people; over your career of leading people here at USAFA and other places. Who are some of the people you would name as standouts in their field?

Danny Litwhiler: Rich Schooff, has had a tremendous impact on issues external to us, working with United States Pacific Command (PACOM), doing some wonderful things for them. Carl Bodenschatz was quite active as an expert witness on statistical inference on a number of high visibility UCMJ (Uniform Code of Military Justice) actions around the world.

Prior to them, I'd say Steve Schmidt; he's the one who got me convinced that design of experiments (DOE) is the way to go; it is a phenomenal impact that Steve has had in the applied statistics area. Steve wrote a couple of undergraduate texts, to help totally revise our statistics program. He created short courses in DOE to present all over the Air Force and other DoD agencies, and got many of my faculty involved in that. There's a long list of things that Steve was able to accomplish using DOE—he got the engineering faculty involved. Nearly all the engineering departments were involved with using DOE for various projects. One I recall was optimizing the makeup of lunar concrete. In class we still use his innovative "statapults"—a small wooden catapult, as a teaching tool.

Tom Curry—Tom brought a number of interesting projects to us, one I recall is AIDS (Acquired Immune Deficiency Syndrome) epidemic modeling. The model was not developed by us, but we did the analysis to validate it. This

model was credited with saving 12 million lives in Africa by determining how to intervene in the AIDS epidemic. The math department was very involved in this analysis. There was a drug interdiction model that he and his fellow researchers developed, using a Markov chain type of analysis. Tom and his co-researchers presented it to the Coast Guard. Eight members of the department got the Coast Guard Special Operations ribbon for their efforts. Concerning drug interdiction this one particular year, in the first three months they had some "hits," but in the fourth month they had exceeded all the hits they had in the first three months with this model. Our guys were trying to go undercover, because they didn't want anybody to know that they were the ones that developed this model that was being so successful, essentially shutting down the seagoing drug trade.

Tom was also involved in hurricane predictions, having done some dissertation work on hurricane tracking. He had a personal model on his office computer. I can recall him posting his predictions on the bulletin board. He'd post them next to the National Weather Service predictions and he was routinely beating their predictions with his little laptop model; just amazing.

The James brothers, Glenn and Doug James, teamed with a few other people one weekend between a Friday and Sunday to provide significant help in the Desert Storm war effort. One Friday afternoon a call came in to Steve "Flash" Gordon, the department head while I was Vice Dean. As a result of the call I just knew that they were burning midnight oil that weekend. We got a call from the fighter wing at Nellis AFB saying they were having some troubles with the Maverick bunker busters: trouble "killing" planes. They were either going off too soon or they were going through the bunker deep into the ground and going off too late. They didn't know what to do. So the math department folks got together and got some information on the timing fuses and a couple of charts from Hughes Aircraft with information on penetration tests and then they tried to figure out a model. We had these two inputs and the third thing was lots of prayer. They prayed it would be a differential equations model; that's what they were hoping. They had three different approaches they were going to try. One of them

was constant deceleration, another was a quadratic deceleration model and the third one was a constant material resistance. It ended up that the third one was the one that worked—very well. When they started doing tests on these models, they found out that with the high speeds that this Maverick bunker buster flies into material, most material reacts like thick jello. Concrete is like thick jello at these speeds, so they could assume it was a constant material resistance as it goes through this bunker. Discovering this, they made up what they called pilot-proof charts. They sent the charts to Nellis—once you figure out where you are going and what the bunker is like, you refer to the charts and set the timing fuse accordingly and launch. They sent it off and didn't hear anything back. No thank you, no nothing. But about a week and a half later General Schwarzkopf goes on national TV, talking about this superb breakthrough that they had. They are all of a sudden clobbering the Iraqi aircraft in Desert Storm in these bunkers. It's very similar to that drug interdiction model they created that was so successful. However, we never heard back. The only thing we know for sure is that Glenn James got promoted early to major.

Bob Sheldon: That's like the WW II Operations Researchers doing fuse studies.

Danny Litwhiler: Yes. That was typical of the kind of things that happen. You get a phone call out of the blue from folks, saying they need help. Even though this time we didn't get any applause or adoration, that's fine, we know what we did. And we were just there to answer phones and help people out. Similarly, some cadets are out at summer research and they graduate a year later and whoever they were doing research with says how can we get this new lieutenant on our staff? A lot of the first assignments end up being those particular lieutenants going for those particular jobs.

Bob Sheldon: You commented earlier, you are not only teaching cadets but you are bringing in faculty and then sending them out into the world. What is your view about teaching math at USAFA being a good training ground to becoming a good analyst?

Danny Litwhiler: It's outstanding. They become phenomenal platform briefers after they leave. They have a level of confidence they did

not have when they came here. Many of the fun videos we have are the young officers coming in and doing their first teaching experience. We video it. I had mine videoed and I watched it and it was not funny to me. I could not believe anybody would want to sit through my classes. What you see in their second or third lesson and what they become, after 2-3 years here, is an amazing transformation.

We have a fairly good proportion of our faculty now that is civilian. In the earlier years, we had no civilian faculty members, except for a visiting professor every few years. But Senators McCain and Nunn, and a few other people, decided we needed a mix of civilian faculty just like the Naval Academy. We begrudgingly said, "OK, we will go to 25 percent." On reflection, it was actually a pretty good thing to do. I was one of the early nay-sayers. What has happened though, is that we now have a sub-group, 25 percent, that has to publish to get promoted, and it's tough on them considering the heavy demands of our teaching mission. They don't have to publish at the rate that they have to do at a typical university, but they do have to publish a few papers in fairly prestigious journals to achieve an academic promotion.

Bob Sheldon: Is it military related stuff or does it have to be more academic?

Danny Litwhiler: It doesn't have to be military related. For example, we hire algebraists, we hire complex analysis specialists, and we hire the best teacher we can find in such fields. It just so happens that their background might be in algebra, so they will probably publish in that field. For a few years we have to live with that, we have to let them do that, so they can get promoted to associate professor and later, full professor. Yet they are still teachers at heart. They love teaching and they stay here. I had the highest turnover for a while of any other department. I was hiring civilians that, for some reason, didn't stay, didn't buy into what we had, what we were about. But now we have a core of civilian faculty that is just phenomenal—very innovative, teaching oriented. But, in the back of their minds, unlike the military officers, they know that they have to get some publications listed in their vitae.

Bob Sheldon: What are the cadets' responses to the civilian faculty as compared to the military faculty?

Danny Litwhiler: I'd say very good, because we are very selective and we hire very good teachers. In fact, they are winning a number of the annual teaching awards. One of the top awards used to be called the Outstanding Military Educator Award. Well, we had to change it to the Outstanding Academy Educator Award because the newly added civilian faculty component was doing an outstanding job in the classroom and winning the award in various departments, including the math department.

Bob Sheldon: Is there any friction between the military and the civilian faculty or was it pretty smooth?

Danny Litwhiler: I think it was a pretty smooth transition. However, some of the earlier hires I lost within a year or two. One of the reasons I was losing them, I think, was that they were usually brand new out of college, brand new PhDs, and had no experience with college teaching in any environment. They came here and they had this ideal in their minds about what academic life was and it wasn't what they thought it would be. For example, all their military friends were moving within two years and they were going to stay forever and somehow it didn't settle well with them. More recently, I hired people that had been on a civilian faculty for three to four years, who had been absolutely miserable at their former universities. I hired them and they are in heaven. They love it here; I could not pry them out of here. So, hiring civilian faculty members isn't a problem anymore. Their classroom environments are as military as any other classroom we have in the math department. They are avid proponents of our military mission.

Bob Sheldon: Academically, how do you view the Academy math department compared to some of your civilian university counterparts?

Danny Litwhiler: I think the talent of our students is as good as any in the nation; we get young men and women from the top 25 percent in the nation for potential. The ones that declare mathematics are the best of the best—I'm slightly prejudiced there. But there are so many less challenging majors you can pick here and to pick mathematics or OR on top of the immensely challenging core, military, and athletic requirements and say, "I'm going to do that,"

they are biting off a huge chunk. It's amazing what they can accomplish.

Our faculty is dedicated to teaching. There are no graduate assistants, everyone has a master's degree or above, and they are dedicated to teaching. That's what they are here for: creating outstanding second lieutenants. I'll put the math department and its faculty against any faculty in this nation of ours. And I'll match the education the cadets get against any education they could get anywhere.

Bob Sheldon: Have you noticed here, since you started in 1972 and retired in 2006, the students and how they handle the math courses and the curriculum, now as compared to 1972?

Danny Litwhiler: Good question. The talent is the same and the energy is the same. That has not changed. What has changed is what they bring with them to the Academy. That is an absolute confidence with computers and technology. We old folks, slide rule people, begrudgingly took on the handheld calculator as a classroom tool. I can remember General Lochry pushing to put the calculator in, and a number of the old crew saying, "You cannot put the programmable calculator into the curriculum, you cannot learn mathematics properly without a slide rule, you can't do that." That is where we've come from. These cadets come in to class with a laptop computer that they buy when they first get here, and they are absolutely whizzes on these things, which allows us to up the ante on what goes on in the classroom.

They learn more mathematics now than we did in the old days, even with less math courses in the core. Their Calculus III is unlike the Calculus III we had in 1972. Their differential equations course is (don't tell the cadets this) over a magnitude, maybe two, what we taught in differential equations years ago; this is because of what we can do with the computer and the fact that non-technical majors don't take these two courses any more. They can easily create representations of very complex vector fields, they can better understand concepts such as flux, and virtual three dimensional graphing is easily done. Integration tables? Forget it! Remember how much time we spent using and learning integration tables? What a waste of time with what the cadets have now at their fingertips.

Modeling is now a primary emphasis in the core courses. We get them so much further and they are so much more capable and have so much more confidence in going out and solving problems than what we ever were able to do in past decades.

Using the computer to help develop models of real-life applications, both numerically and analytically, is so huge in the mathematics work we are doing now, throughout the curriculum. We're using computers in courses such as complex analysis and topology. I doubt that is being done in many other schools.

Bob Sheldon: A buzz phrase while I was teaching here was "writing across the curriculum." Some of the math professors thought it should be math across the curriculum. Do you have any thoughts on that?

Danny Litwhiler: An interesting comment. I have two civilian faculty members that have taken this and run with it. Writing across curriculum is huge in the math department. For the cadets, this drives them nuts. "This is math. What am I doing writing in here? Are you an English teacher?" And of course the faculty response, to a great extent, is "I declared math as a major so I wouldn't have to grade things like this." The English department head, about a year ago, praised us to the Dean, praised the math department, about how well we are doing in writing across the curriculum, that we are the leaders in the faculty in writing across the curriculum. It is somewhat painful. Instead of handing in 20 tests with answers boxed with numbers, we handle 20 papers, or if you have 5 sections, collecting 100 papers that have to be read and graded. That is painful for a math teacher. Yet, it's amazing how cadets improve their writing ability over a couple semesters.

It's quite surprising in Math 130, our remedial math course, which I've taught a number of times, how good some of them are at writing. They don't understand math at all, but they are good writers. So I suggest they might consider being English majors and hope to survive the challenging technical core. One of them graduated a few years ago, and he was one of the top English majors. They have an opportunity to express themselves, to show that they can do something positive. Understand, they

cannot solve an integral, maybe, but they can explain what it is—how about that? And, solving a correctly modeled integral is not that difficult anymore if you can feed it into the computer correctly. Now we hope they understand what it is and use the computer to solve it—it's a different brand of success.

Bob Sheldon: Now that you have retired from the math department, what are your plans for the future?

Danny Litwhiler: Getting to know our five grandkids and eight granddogs better, see our four children and close relatives as often as possible, and travel. I'll be doing some volunteer work somewhere once I've settled in to being retired.

Bob Sheldon: You answered all my questions. I probably put Mike out of the loop, so I'll see if you have any questions.

Mike Lyons: I just wanted to ask about the civilian faculty and what impact or contributions they have made since their arrival.

Danny Litwhiler: We have hired a spectrum of civilian faculty members and currently we have 10 civilian faculty, with two that have an OR background. They have been very good for continuity, to come in and know they are going to be here for a number of years and help refine the curriculum, because a large percentage of the military faculty is not going to be able to stay here much longer than four years. There won't be many specimens like me in the future. The Sequential Tour Officer concept has been killed, they don't allow them anymore. As a result, the civilian faculty, those two OR people that I have, for example, will be the continuity. One of them, Brad Warner, has a Navy background, and he has drawn a one-year sabbatical already to Space Command. He has done some good work down there. The other, Ralph Boedigheimer, is retired military; he had been here a number of years on the faculty as an active duty officer. I brought him back after about five years out from retirement, which I had not done before. Current leadership says that's not to be done anymore, except in very rare cases. The other departments in the faculty have ended up with too many retired military according to some folks back on the East Coast. I can see the value of having them, but I guess there is some kind of breakeven point that somebody has

determined. However, there is an Inspector General case going on right now over one of another department's potential hires. Leadership has said that he can't be hired because he is retired military—interesting case.

Bob Sheldon: This is a non-mathematical question. When I was here, you encouraged your faculty members to go to the gym a lot. Do you have any comments on that?

Danny Litwhiler: We had a couple of things; one was to encourage 4-5 hours a week of physical fitness—do something, whatever it is. You have marathon runners that take more than 4-5 hours a week, but large numbers of others can never find the time. We had that and also we have what we called "Family Time," but one of my Deans did not like the idea of "Family Time." That's an Army thing. I got that from my two Army officer sons; I have twin sons in the Army. About once a week I encouraged Family Time for about 2-4 hours. You go and be with your family—do something with them. That was extremely popular. You were not allowed to go and play golf with your buddies; it was to be with your family. I justified that because I was getting an average of 55 hours a week work out of them whether I had family time or not. They did their family time and still worked their 55 hours a week on average. The Dean did not like that, so we have what we call "Excellence Time" now. *(Laughter)* Excellence Time is the phrase used by the Commandant and the Cadet Wing for cadet personal time.

"Superstars" were also a big deal in the past; we had competitive physical events, it was all physical things. We had some things like running up and down the stairs (twelve flights of stairs) with your combat boots on, or racing on the ice rink in tennis shoes. Superstars. Physical fitness is a huge thing. Of course now it's an Air Force thing, a constantly evolving program; they have some strange things that they've been doing, such as the ergo cycle and pinch tests to determine body mass indices. But, at long last they are back to running again.

Bob Sheldon: You got teased about the family thing. You promoted good family relationships, and one year you bragged about how many births there were from the math department and you took credit for it.

Danny Litwhiler: *(Laughter)* We had 13 babies one year. It's still likely a record for the entire faculty.

Bob Sheldon: Any other comments you want to make for the record?

Danny Litwhiler: I sure enjoyed having the opportunity and I was blessed to be so long at USAFA, off and on, four or five times and feel very comfortable in retiring. I say the future is very bright. We've got a wonderful department head; John Andrew has tremendous connections in the Air Force analysis world, and he's going to do very well. He has a phenomenal young faculty, and if there is anything I will miss, I sure wish I could work with the new faculty that we have brought in this last year. This concept that Dr. Henningsen has created, with the support of our last two Chiefs of Staff, this Combat Analyst concept, is an awesome concept and it's going to do wonders for the analysts in the Air Force and at the Academy. For a number of recent years, we have had some difficulty with promotions for our analysts. I've seen it happen, non-selection of some really good people, and some of them have been in the math department; this might help fix that. They are going over to the "front lines," and they are winning the Bronze Star, as an analyst.

While I was off "doing my thing," we had two of our department heads in math volunteer to serve deployments to the Green Zone. Combat analysts. It just looks so good for the future of the analysts in the Air Force. John Andrew, current department head was over in the Green Zone; he won the Bronze Star. Jerry Diaz, department head while I was on sabbatical to HQ EUCOM, also.

Bob Sheldon: The introductory OR 310 course was proposed to be part of the core curriculum. What's the status?

Danny Litwhiler: Sadly, it's not a core course. We tried, we gave it a shot. It would have been nice, but it did not become part of the core. OR 310 is one of seven courses that satisfy the core "energy/systems option." It is a core course for some cadets. We kept the stats course as part of the core. There have been some battles over that, too. In the early years, we had five math core courses. We had 70-some people in the math department to teach those five core courses. I worked with General Lochry

back in the mid-80s, because of a Dean's direction, to reduce the core curriculum. We agreed to eliminate Calculus III and differential equations from the overall core, yet all engineering people would still take those courses. It made it possible for us to "turn the dial up" in these two courses. When you take the 200-or-so remedial math troops out of Calculus III and differ-

ential equations, you can teach a different course. And we do—don't tell the cadets. The courses are now taught at or higher than the level taught at the best engineering schools in the nation. We're better for it. There are much better engineers and analysts coming out of here now due to a much stronger foundation in engineering mathematics.